

APPLICATION
FOR
UNITED STATES LETTERS PATENT

PATENT APPLICATION

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that Joseph J. Schwetz of 59 Sunset Lane, Attleboro, MA 02703 has invented certain improvements in APPARATUS AND METHOD FOR WELDING OVERLAPPING WATER-PROOF MEMBRANES TO EACH OTHER of which the following description is a specification.

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3 APPARATUS AND METHOD FOR WELDING OVERLAPPING

4 WATER-PROOF MEMBRANES TO EACH OTHER

5
6 BACKGROUND OF THE INVENTION

7 1. Field of the Invention

8 The invention relates to an apparatus for heat welding two
9 overlapping waterproof membranes to each other, and is directed
10 more particularly to such an apparatus provided with improved
11 structure for welding along outside edges of the area to be
12 covered with the membranes.

13 2. Description of the Prior Art

14 It is known to provide an apparatus for heat welding two
15 overlapping waterproof membranes attached to a surface, such as a
16 roof top, deck, terrace, or other surface. See, for example, U.S.
17 Patent No. 6,325,126, issued December 4, 2001, to James Rubenacker
18 et al.

19 The '126 patent relates to a machine for effecting continuous
20 heat welds for binding an upper membrane to a lower membrane
21 underlying in part the upper membrane. To effect the welds, the
22 machine described in the '126 patent is provided with nozzle means
23 which directs hot air onto the weld area. The upper overlapping
24 membrane is heat sealed to the lower overlapped membrane along the
25 overlap portion to seal the two membranes together. To effect the

1 weld, the nozzle means is moved by the machine between the two
2 membranes, under an edge of the upper membrane.

3 The aforementioned U.S. Patent No. 6,325,126 (commonly owned
4 by the assignee herein) is incorporated herein by reference.

5 While the apparatus shown and described in the '126 patent effects
6 "field seam welding" quite well, that is, welding two membrane
7 strips together, it is not well suited for welding the outboard-
8 most strip outboard-most edge to an outer edge of the supporting
9 roof, or other structure, that is, "edge welding". Such edge
10 welding is customarily accomplished by a machine devoted wholly to
11 edge welding, or done by hand. There is thus a need for a machine
12 which is adapted for membrane field seam welding and, in addition,
13 for edge welding in a quick and easy fashion.

14 15 SUMMARY OF THE INVENTION

16 It is, therefore, an object of the invention to provide a
17 membrane welding machine having a quick-change structure which
18 facilitates adapting the machine to perform a selected one of
19 field seam welding and edge welding.

20 With the above and other objects in view, as will hereinafter
21 appear, a feature of the present invention is the provision of an
22 apparatus for heat welding to each other two overlapping
23 thermoplastic membranes mounted on a surface. The apparatus
24 includes a frame having drive wheels mounted thereon for
25 locomotion of the frame, and a support member connected to the

1 frame. A nozzle is mounted on the support member and is adapted
2 to receive heated air from a heat source mounted on the frame, the
3 nozzle being adapted to direct the heated air to a weld location
4 beneath an upper one of the membranes. Weld wheels are mounted on
5 the support member and mounted adjacent to, and in operation
6 immediately following, the nozzle for pushing a heated portion of
7 the upper one of the membranes toward the surface to effect a
8 weld. The support member is adapted to be fixed to the frame
9 member in a first position proximate a first side of the frame for
10 welding the two membranes together, is adapted for release from
11 the first position, is movable on the frame to a second position
12 nearer a second side of the frame, and is adapted to be releasably
13 fixed to the frame at the second position for welding one of the
14 membranes to an underlying edge piece mounted on a free edge of
15 the surface.

16 In accordance with a further feature of the invention, there
17 is provided an apparatus for heat welding to each other two
18 overlapping thermoplastic membranes mounted on a surface and for
19 heat welding one of the membranes to an angle piece disposed on a
20 free edge of the surface. The apparatus includes drive wheels for
21 providing for locomotion of the apparatus and adapted to be
22 disposed in a first location on the apparatus for the welding of
23 the two overlapping membranes to each other, a nozzle adapted to
24 be disposed in a first location on the apparatus for directing
25 heated air to a weld area between the two membranes, and weld

1 wheels adapted to be disposed in a first location on the
2 apparatus for the welding of the two membranes to each other. At
3 least one of the drive wheels, the nozzle, and the weld wheels are
4 each movable to a second location on the apparatus for the welding
5 of the one membrane to the angle piece.

6 In accordance with a further feature of the invention, there
7 is provided a method for welding an edge of a thermoplastic strip
8 to an angle piece fixed on a free edge of a surface to which
9 thermoplastic strips are being attached. The method includes the
10 steps of providing an apparatus for heat welding to each other two
11 overlapping thermoplastic membranes mounted on a surface, the
12 apparatus including a frame, a support member connected to the
13 frame, a nozzle mounted on the support member and adapted to
14 direct heated air to a weld location beneath an upper one of the
15 membranes, weld wheels mounted on the support member adjacent to,
16 and in operation immediately following, the nozzle for pushing a
17 heated portion of the upper one of the membranes toward the
18 surface to effect a weld, wherein the support member is adapted to
19 be fixed to the frame in a first position proximate a first side
20 of the frame for welding the two membranes together, releasing the
21 support member from the first position, moving the support member
22 from the first position to a second position on the frame nearer a
23 second side of the frame, releasably fixing the support member on
24 the frame in the second position, placing an angle piece on the
25 surface free edge, the angle piece having a coating of a plastics

1 material on an upper surface thereof, and moving the apparatus
2 along the edge of one of the thermoplastic strips with the nozzle
3 disposed between the one thermoplastic strip and the coating on
4 the angle iron, whereby to weld the thermoplastic strip edge to
5 the angle piece upper surface.

6 In accordance with a still further feature of the invention,
7 there is provided a method for heat welding to each other two
8 overlapping thermoplastic membranes mounted on a surface and for
9 heat welding one of the membranes to an angle piece mounted on a
10 free edge of the surface. The method includes the steps of laying
11 the two membranes on the surface such that edge portions of the
12 two membranes overlap. Providing an apparatus including
13 drivewheels for providing for locomotion of the apparatus and
14 adapted to be disposed in a first location on the apparatus for
15 the welding of the two overlapping membranes to each other, a
16 nozzle adapted to be disposed in a first location on the apparatus
17 for directing heated air to a weld area between the two membranes,
18 and weld wheels adapted to be disposed in a first location on the
19 apparatus for the welding of the two membranes to each other. At
20 least one of the drive wheels, the nozzle, and the weld wheels are
21 each movable to a second location on the apparatus for the welding
22 of the one membrane to the angle piece. Placing the drive wheels,
23 nozzle, and weld wheels in the first locations thereof,
24 moving the apparatus along the overlap of the two membranes, such
25 that the nozzle directs heated air between the two membranes and

1 the weld wheels thereafter press the two membranes firmly
2 together, placing the angle piece on the free edge of the surface,
3 moving the at least one drive wheel, nozzle, and weld wheels to
4 their second locations, and moving the apparatus along an outboard
5 edge of the one membrane such that the nozzle directs heated air
6 between the one membrane and the angle piece and the weld wheels
7 thereafter press the one membrane and the angle piece firmly
8 together.

9 The above and other features of the invention, including
10 various novel details of construction and combinations of parts
11 and method steps, will now be more particularly described with
12 reference to the accompanying drawings and pointed out in the
13 claims. It will be understood that the particular apparatus and
14 method embodying the invention are shown by way of illustration
15 only and not as limitations of the invention. The principles and
16 features of this invention may be employed in various and numerous
17 embodiments without departing from the scope of the invention.

18

19 BRIEF DESCRIPTION OF THE DRAWINGS

20 Reference is made to the accompanying drawings in which is
21 shown an illustrative embodiment of the invention, from which its
22 novel features and advantages will be apparent.

23 In the drawings:

24 FIG. 1 is a left side substantially elevational view of one
25 form of apparatus illustrative of an embodiment of the invention;

1 FIG. 2 is a right side substantially elevational view of the
2 apparatus of FIG. 1;

3 FIG. 3 is a generally front and left side perspective view;

4 FIG. 4 is a substantially bottom view;

5 FIG. 5 is similar to FIG. 4, but showing parts in shifting
6 positions;

7 FIG. 6 is a similar to FIG. 5, but showing the shifting parts
8 of FIG. 5 fully shifted to a further location on the apparatus;

9 FIG. 7 is a front substantially elevational view of the
10 apparatus, showing the shifted components in their shifted
11 positions;

12 FIG. 8 is a front elevational view of a portion of the
13 apparatus disposed along a free edge portion of a surface being
14 operated upon; and

15 FIG. 9 is similar to FIG. 3, but showing the apparatus
16 disposed along the edge of a structure, with shifted components
17 positioned for edge welding.

18 19 DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 Referring to FIGS. 1-4, it will be seen that a welding
21 apparatus of the type referred to hereinabove includes a frame 10
22 to which is fixed a handle 12 and on which are mounted drive
23 wheels 14 and weld wheels 16. A hot air nozzle 18 is supported on
24 the frame 10 for directing heated air to an area immediately
25 forward of, and proximate to, the leading weld wheel 16a. A

1 housing 20 is mounted on the frame 10 for enclosing a motor 22
2 (FIG. 4), a blower (not shown) and various electrical components
3 and controls (not shown). The nozzle 18 is fixed to a heating
4 element 24 which, in turn, is connected to a flexible conduit 26
5 which is in communication with the blower carried by the frame 10.

6 In operation for the usual purpose of effecting field seams,
7 the nozzle 18 is positioned between overlapped edge portions of
8 two membranes. The motor 22 drives the drive wheels 14, thereby
9 driving the apparatus forwardly, the forward end of the apparatus
10 being the end having the handle 12 thereon. The blower forces air
11 through the conduit 26, through the heating element 24, and
12 through the nozzle 18. As the apparatus moves along, a jet of hot
13 air from the nozzle 18 is directed between the membranes.

14 Immediately following hot air impingement on the membranes, the
15 weld wheels 16 press the upper membrane against the lower membrane
16 to secure the membranes together.

17 The nozzle 18 extends from a tubular chamber 28 which
18 receives the heated air at a selected temperature. The nozzle 18
19 comprises in part a hollow, generally flat, blade-like portion 30
20 at a discharge end of the chamber 28.

21 As may be seen in the aforementioned '126 patent, the nozzle
22 may be provided with two outlet portions, not shown herein but
23 illustrated in the '126 patent, incorporated herein by reference.
24 The two outlets direct two streams of heated air in spaced,
25 generally parallel paths, typically on opposite sides of a

1 fastener means by which the lower membrane is mechanically secured
2 to the surface being covered with the thermoplastic membranes.

3 The weld wheels 16 may be free-wheeling, or may be driven so
4 as to serve the purposes of both drive wheels and weld wheels. In
5 the embodiment illustrated, for example, the leading weld wheel
6 16a is also a drive wheel, while the trailing weld wheel is free-
7 wheeling and serves simply as a weld wheel.

8 The conduit 26 receives air from the blower in the housing
9 20. A portion of the conduit 26, the heating element 24, the
10 chamber 28, the nozzle 18, and the weld wheels 16 are mounted on a
11 support member 34. The support member 34 includes a lug portion
12 36 which is slidably mounted on a rod 38 fixed in the frame 10
13 (FIG. 4). A handle 40 is fixed to a threaded shaft 42 which
14 extends through a treaded bore 44 which extends through a portion
15 of the support member 34 and a portion of the frame 10. The shaft
16 42 is thus movable into engagement with the rod 38 to lock the
17 support member 34 in a selected location on the frame 10.

18 Mounted on the support member 34 is a weight assembly 46
19 including first and second weights 48, 50 (FIGS. 1 and 3) which
20 serve to push the weld wheels 16 downwardly into firm contact with
21 just-heated thermoplastic strip portions. The first and second
22 weights 48, 50 are releasably connected to each other by a
23 threaded shaft extending from a knob 52 (FIG. 3), through a bore
24 in the second weight and into a bore 54 in the first weight 48
25 (FIGS. 7, 8 and 10). The weight assembly 46 is similarly

1 releasably connected to the support member 34 by a threaded shaft
2 extending from a grip member 56 (FIG. 1).

3 To facilitate welding an outboard-most thermoplastic strip to
4 the free edge of the surface, the edge is covered by an angle
5 piece 60, usually of metal, and having an upper surface 62 thereof
6 covered with a coating of plastics material, such as PVC. A
7 thermoplastic membrane 64 is laid over the coating, as shown in
8 FIG. 9.

9 The apparatus, as shown in FIG. 1, if applied to the edge
10 weld in the same fashion as applied to a field seam weld, will
11 fall from the surface inasmuch as a large portion of the apparatus
12 overhangs the surface edge and is unsupported. Given that the
13 surface being treated is quite often a roof or other elevated
14 surface, a fall can be not only destructive to property but a
15 hazard to safety, and leaving the intended task unaccomplished.
16 For such reasons, the edge welding is done typically either by
17 hand or by a further machine designed specifically for edge
18 welding.

19 Referring to FIGS. 4 and 5, it will be seen that by manual
20 manipulation of the handle 40, the shaft 42 is movable from
21 engagement with the rod 38, to permit the support member lug
22 portion 36 to be moved along the rod from the position shown in
23 FIG. 4 through the position shown in FIG. 5, and on to the
24 position shown in FIG. 6, at which point the shaft 42 is again

1 brought to bear on the rod 38 to lock the support member 34 in the
2 location shown in FIGS. 6 and 7.

3 The flexible character of the conduit 26 permits movement of
4 the support member 34 on the frame 10 without interruption of air
5 flow from the blower in the housing 20 to the heating element 24,
6 chamber 28, and nozzle 18.

7 In addition to moving the support member 34 widthwise on the
8 frame 10, the weight 50 is removed by manipulation of the knob 52
9 from the position shown in FIG. 1, where the weight 50 comprises a
10 portion of the weight assembly 46, and placed in the position
11 shown in FIG. 2, where the weight 50 adds to the inboard weight of
12 the apparatus.

13 Referring to FIG. 4, it will be seen that the drive wheels 14
14 are mounted on an axle 66 in a side-by-side manner. One of the
15 drive wheels 14a (FIG. 5) is movable on the axle 66 closer to the
16 other drive wheel, such that the drive wheels can be close
17 together (FIG. 6) and in operation disposed on the thermoplastic
18 membrane 64. The movable wheel 14a is thus moved from an outboard
19 position to a more central position to better support the frame 10
20 in an edge welding operation.

21 As shown in FIGS. 8 and 9, the apparatus, as reconfigured, is
22 moved along the edge of the surface, such that the nozzle 18
23 directs heated air between the thermoplastic membrane 64 and the
24 PVC layer on the upper surface of the angle piece 60. The weld

1 wheels 16 immediately follow to press the heated membrane 64 into
2 firm engagement with the angle piece 60, to weld the two together.

3 The reconfiguration of the apparatus requires very simple
4 mechanical operations and only a few minutes time.

5 There is thus provided an apparatus and method which enables
6 the use of a machine for effecting field seam welds to be further
7 useful in effecting edge welds, and requiring minimal
8 reconfiguration time and effort.

9 It will be understood that many additional changes in the
10 details, materials, steps and arrangement of parts, which have
11 been herein described and illustrated in order to explain the
12 nature of the invention, may be made by those skilled in the art
13 within the principles and scope of the invention as expressed in
14 the appended claims.